

The Relation between the Maintenance of Physical Functions and Social Interaction among Community-dwelling Elderly People: A Six-year Follow-up Study

YUKO SAWADA, MA¹⁾, RYOJI SHINOHARA, MA¹⁾,
YUKA SUGISAWA, MA¹⁾, TOKIE ANME, PhD¹⁾

¹⁾International Community Care and Life-Span Development Graduate School of Comprehensive Human Sciences University of Tsukuba: 1–20–2 Aoba-dai Izumi-city, Osaka 594-1153, Japan.
TEL: +81 725-57-3324, FAX: +81 725-57-3324, E-mail: ysawa1110@yahoo.co.jp

Abstract. [Purpose] This study was aimed at exploring relation between social interaction and maintenance of physical function for community dwelling elderly by six-year follow-up. [Subjects] This study enrolled all individuals aged from over 60 years to under 75 years living in a farming village (total population: 4,688, of whom 14.6% were farmers) neighboring a large city in the Chubu district of Japan. There were 113 males and 106 females, with a mean age of 65.72 ± 4.18 years. [Methods] We investigated the age, gender, and disease, social interaction, and physical function (mobility). The baseline study was conducted in 2002 with a follow-up in 2005 and 2008. The chi-square test and multiple logistic regression analysis was used to examine the relationships of maintenance of physical function with age, gender, and disease, and social interaction. Analyses were performed using the computer program SAS. [Results] The results of the present study indicate that maintenance of physical function related with social interaction. After 3 years, physical function was related to social interaction related, odds ratio (OR) 1.301 (95%CI 1.047–1.615). After 6 years, social interaction, age, and gender related, OR 1.238 (1.023–1.499), 1.247 (CI 1.104–1.408), 0.318 (0.118–0.857). [Conclusion] This study was explored the relation between social interaction and maintenance of physical function for community dwelling elderly. These in conjunction with more multiple analyses deserve further study. To examine the mechanisms of maintenance of physical function need to be determined in detail.

Key words: Physical function, Longevity, Japanese elders

(This article was submitted Jul. 8, 2010, and was accepted Sep. 6, 2010)

INTRODUCTION

The Japanese society is aging at a rapid pace¹⁾. In recent years, the continuous residence in a region by the elderly has become a focus of attention^{2,3)}. It is important to preserve the quality of life⁴⁾. In order to maintain a healthy life, the physical functions of the body must be maintained^{5,6)}. Several studies have been conducted to ascertain the physical functions of Japan's community-dwelling elderly^{7–9)}. The risk factors involved in the maintenance of physical functioning in this population have been identified in longitudinal studies^{10,11)}. Many trials of complex intervention packages have been reported and reviewed¹²⁾. These verifications have focused on both the general and the frail elderly populations, as well as on those at risk of falling^{13–15)}. Some research has demonstrated a relationship between social interaction and mortality among older adults^{16–19)}. The distinct components of the social relationships of older persons are one of the components of these inquiries. The purpose of this six-year follow-up study

was to investigate the relation between maintenance of physical functions and social interaction.

SUBJECTS AND METHODS

This study enrolled all individuals aged over 60 years and under 75 years living in a typical farming village (with a total population of 4,688, 14.6% of whom were farmers), located near a large city in the Chubu district of Japan. Beginning in 1991, the Tobishima Study sought to investigate the factors associated with longevity among the elderly, with the goal of creating for residents a health-promotion program that would maximize the duration and quality of life. All of the residents were invited to participate with informed consent, and all agreed.

In 2002, 698 persons aged over 60 years and under 75 years were included in the study. Of these persons, 641 actually answered the questions posed (response rate: 91.83%). Three hundred and six of these replied to those items that were necessary for the proposed analysis. There

were no significant gender or age differences among the participants and nonparticipants. Two hundred and eighty of the participants possessed independent physical functions. Six years later, 219 of the original group were available for the follow-up inquiry. This study cohort included 113 males and 106 females, with a mean age of 65.72 ± 4.18 years.

The present study examined the age, gender, disease status (the presence and absence of disease, including diabetes, high blood pressure, and heart problems), physical function, and social interaction of each subject. In this study, we measured physical function by “mobility”, that is a basic ability for the elderly to living in the community. In a question form, did not need assistance as independence, and need assistance as dependent. After 3 years or 6 years, to keep independent as “maintenance of physical function”.

Social interaction was measured using the Index of Social Interaction (ISI: Table 1)^{20,21)}. One of the authors (Anme) developed this scale. The scale includes 18 items for evaluating social interactions of various types in Japan. Factor analysis centered on five subscales: (1) Independence, which includes the motivation to live an active lifestyle, to take an active approach toward one’s life, to seek a healthy life, and to follow a regular routine; (2) Social curiosity, which comprises reading newspapers and books, trying to use new equipment, having a hobby, and possessing a feeling of importance; (3) Interaction, which entails communication within and outside the family and interactions with persons who are not relatives; (4) Participation in society, which entails participation in social groups, involvement in neighborhood affairs, watching television, and an active engagement in society; and (5) Feelings of safety, access to advice, and access to support in an emergency. Cronbach’s alpha for the subscales ranged from 0.78 to 0.81. Total or subscale scores were calculated

by adding each item’s score. A negative response was rated as 1, and a positive response, as 0. The mean score of all the items replaced missing values for items in ISI. We defined low social interaction as infrequent person-to-person social contacts (no such contacts in the workplace or with families, neighbors, friends, or relatives) and the loss of interest in social activities (no social role, ignoring social circumstances).

The chi-square test was used to determine the relationship between socio demographic variables, health status, ISI contents, and physical functions. In addition, a multiple logistic regression analysis was performed to determine the maintenance of physical functions on the basis of the ISI score, after controlling for age, gender, and health status.

RESULTS

Social interaction and physical function are presented in Table 2. An analysis of each item on the ISI revealed differences across time. At the three-year mark, the following items were significantly related to the maintenance of physical functions: desiring an active lifestyle, taking an active approach, following a routine, reading newspapers, trying to use new equipment, participating in community affairs, watching television, and playing an active role in society. At the six-year mark, the following items were significantly related to the same factor: desiring an active lifestyle, taking an active approach, following a routine, reading books, trying to use new equipment, feeling important, interacting with non-family persons, and participating in neighborhood affairs.

A multidimensional analysis of ISI and physical functions (Table 3) was performed. Using logistical regression, an independent analysis was performed at three

Table 1. Index of Social Interaction (ISI)

1. Independence	
Motivation to live an active lifestyle	Do you have motivation to live an active lifestyle?
Taking an active approach	Do you take an active approach towards your life?
Being motivated to live a healthy life	Are you motivated to live a healthy life?
Having regular lifestyle	Do you have a regular or routine lifestyle?
2. Social curiosity	
Reading newspapers	Do you read newspapers regularly?
Reading books	Do you read books or magazines regularly?
Try to use new equipments	Do you try to use new equipments like a video?
Having a hobby	Do you have any hobby?
Feeling of importance	Do you have feeling of importance in the society?
3. Interaction	
Communication within the family	Do you often communicate with your family members?
Communication with non-family persons	Do you communicate with non-family persons regularly?
Interaction with non-family persons	Do you interact with non-family persons regularly?
4. Participation in the society	
Participation in social groups	Do you have chance to participate in social groups?
Participation in neighborhood affairs	Do you have chance to participate in your neighborhood affairs?
Watching television	Do you watch television?
Having an active role in society	Do you have an active role in the society or social affairs?
5. Feeling of safety	
Having counsel	Do you have someone to counsel with in difficult situation?
Having someone to give support in emergency	Do you have someone to support you in emergency?

Items divided into five subscales by factor analysis. Cronbach =0.78 reliability=0.81.

Table 2. Social interaction and mobility after 3 and 6years

		mobility after 3years			mobility after 6years		
		independent	dependent	p	independent	dependent	p
gender	femal	101	5		90	16	
		95.3	4.7		84.9	15.1	
	male	108	5		105	8	
		95.6	4.4		92.9	7.1	
disease	no	146	5		138	13	
		96.7	3.3		91.4	8.6	
	yes	63	5		57	11	
		92.6	7.4		83.8	16.2	
1. Independence							
Motivation to live an active lifestyle	yes	204	7	**	192	19	**
		96.7	3.3		91.0	9.0	
	no	5	3		3	5	
		62.5	37.5		37.5	62.5	
Taking an active approach	yes	203	8	**	191	20	**
		96.2	3.8		90.5	9.5	
	no	6	2		4	4	
		75.0	25.0		50.0	50.0	
Being motivated to live a healthy life	yes	202	9		189	22	
		95.7	4.3		89.6	10.4	
	no	7	1		6	2	
		87.5	12.5		75.0	25.0	
Having regular lifestyle	yes	207	8	**	193	22	*
		96.3	3.7		89.8	10.2	
	no	2	2		2	2	
		50.0	50.0		50.0	50.0	
2. Social curiosity							
Reading newspapers	yes	204	8	**	190	22	
		96.2	3.8		89.6	10.4	
	no	5	2		5	2	
		71.4	28.6		71.4	28.6	
Reading books	yes	156	5		148	13	*
		96.9	3.1		91.9	8.1	
	no	53	5		47	11	
		91.4	8.6		81.0	19.0	
Try to use new equipment	yes	146	3	**	139	10	**
		98.0	2.0		93.3	6.7	
	no	63	7		56	14	
		90.0	10.0		80.0	20.0	
Having a hobby	yes	195	8		183	20	
		96.1	3.9		90.1	9.9	
	no	14	2		12	4	
		87.5	12.5		75.0	25.0	
Feeling of importance	yes	194	8		183	19	*
		96.0	4.0		90.6	9.4	
	no	15	2		12	5	
		88.2	11.8		70.6	29.4	
3. Interaction							
Communication within the family	yes	206	10		192	24	
		95.4	4.6		88.9	11.1	
	no	3	0		3	0	
		100.0	0.0		100.0	0.0	
Communication with non-family persons	yes	204	9		191	22	
		95.8	4.2		89.7	10.3	
	no	5	1		4	2	
		83.3	16.7		66.7	33.3	
Interaction with non-family persons	yes	205	9		192	22	*
		95.8	4.2		89.7	10.3	
	no	4	1		3	2	
		80.0	20.0		60.0	40.0	
4. Participation in the society							
Participation in social groups	yes	140	5		128	17	
		96.6	3.4		88.3	11.7	
	no	69	5		67	7	
		93.2	6.8		90.5	9.5	
Participation in neighborhood affairs	yes	206	8	**	194	20	**
		96.3	3.7		90.7	9.3	
	no	3	2		1	4	
		60.0	40.0		20.0	80.0	
Watching television	yes	207	9	*	193	23	
		95.8	4.2		89.4	10.6	
	no	2	1		2	1	
		66.7	33.3		66.7	33.3	
Having an active role in society	yes	187	7	*	174	20	
		96.4	3.6		89.7	10.3	
	no	22	3		21	4	
		88.0	12.0		84.0	16.0	
5. Feeling of safety							
Having counsel	yes	192	8		178	22	
		96.0	4.0		89.0	11.0	
	no	17	2		17	2	
		89.5	10.5		89.5	10.5	
Having someone to give support in emergency	yes	194	8		180	22	
		96.0	4.0		89.1	10.9	
	no	15	2		15	2	
		88.2	11.8		88.2	11.8	

**: p<0.01, *: p<0.05.

Table 3. Odds for mobility after 3 and 6 years

	mobility after 3 years			mobility after 6 years		
	odds	95% range		odds	95%range	
social interaction	1.301	1.047	1.615**	1.238	1.023	1.499*
age	1.170	0.986	1.388	1.247	1.104	1.408**
gender (1: male 0: female)	0.871	0.222	3.422	0.318	0.118	0.857*
disease (1: yes 0: no)	1.278	0.320	5.110	1.918	0.719	5.117
H-L test		0.826			0.781	

** $p < 0.01$, * $p < 0.05$.

and six years on the ISI score, after controlling for age, gender, and disease. In the three-year analysis, ISI score was found to be related to the maintenance of physical functions, with an odds ratio (OR) of 1.301 (95%, CI 1.047–1.615). In the six-year analysis, the ISI score, age, and gender-related scores were OR 1.238 (1.023–1.499), 1.247 (CI 1.104–1.408), and 0.318 (0.118–0.857).

DISCUSSION

This study examined the relation between social interaction and physical functions. The promotion of a healthy, long-lasting life is an important concern in contemporary Japanese society²⁻⁴). The preservation of the physical functions of elderly people living in the community is crucial^{5,6}). Local governments provide many programs to further this goal, and investigators have noted the positive achievements of these initiatives⁷⁻¹⁰). A study by Saito et al.²²) revealed that participation in social activity and contact with friends helped preserve physical functions among elderly people. Fujita et al.³) reported an association between the frequency of outdoor activity and the preservation of physical functions that is consistent with the results of the present study. Regarding the intervention methods to preserve physical functions, it is necessary to develop and provide programs tailored to the illness of individuals. However, since the mechanism of the decline of physical functions varies according to the underlying illness, it is currently difficult to evaluate various disabilities uniformly²⁵). Our longitudinal analysis reveals that low social interaction is a risk factor for the maintenance of physical functions.

Previous research of the same community examined in the present study arrived at similar conclusions. Anme examined a sample of approximately 1,000 older persons in the community over a five-year period and reported that the measure of social interaction (ISI) is significantly and positively related to longevity even after controlling for age, gender, education, and health status¹⁶). In addition, a follow-up seven-year study found that baseline age and physical functions were related to seven-year mortality, that greater social interaction was positively related to reduced mortality, and that greater social interaction is linked to reduced mortality multiple logistic (regression analysis adjusted for baseline age, gender, physical functions, health status, and ADL)¹⁹). The current study confirmed these

previous observations. The authors attempt to identify the desirable directions in which programs for the maintenance of the physical functions of elderly individuals should take. However, the validity of these indications has not yet been tested. The study was limited to one community and only the relationship of social interaction to mobility was investigated. Further multiple analyses should be pursued. In particular, the mechanisms at work in the maintenance of physical functions need to be determined in detail. At the same time, it is desirable to implement a program designed on the basis of these findings so as to evaluate its effectiveness.

REFERENCES

- 1) White Paper on Aging Society in 2005, Social welfare association 2005.
- 2) Landi F, Onder G, Carpenter GI, et al.: Physical activity prevented functional decline among frail community-living elderly subjects in an international observational study. *J Clin Epidemiol*, 2007, 60: 518–524.
- 3) Fujita K, Fujiwara Y, Chaves PHM: Frequency of going outdoors as a good predictors for incident disability of physical function as well as disability recovery in community-dwelling older adults in rural Japan. *J Clin Epidemiol*, 2006, 16: 261–270.
- 4) Gordon H, Guyatt D, Eagle J, et al.: Measuring quality of life in the frail elderly. *J Clin Epidemiol*, 1993, 46: 1433–1444.
- 5) Hayato N, Yoshikawa T, Mimura T, et al.: Influence of lower-extremity muscle force, muscle mass and asymmetry in knee extension force on gait ability in community-dwelling elderly women. *J Phys Ther Sci*, 2006, 18: 73–79.
- 6) Enoki H, Kuzuya M, Masuda Y, et al.: Anthropometric measurements of mid-upper arm as a mortality predictor for community-dwelling Japanese elderly. The Nagoya Longitudinal Study of Frail Elderly (NLS-FE). *Clin Nutr*, 2007, 26: 597–604.
- 7) Ito T: Roles of physical therapists in the home-based rehabilitation. *J Phys Ther Sci*, 2002, 17: 215–220.
- 8) Hara T, Shimada T: Effects of Exercise on the Improvement of the Physical Functions of the Elderly. *J Phys Ther Sci*, 2007, 19: 15–26.
- 9) Toshimichi S: Elderly peoples' stand up ability and excretion independence. *J Phys Ther Sci*, 2007, 22: 89–92.
- 10) Sugisawa H, Liang J, Liu X: Social networks, social support, and mortality among older people in Japan. *J Gerontol B Psychol Sci Soc Sci*, 1994, 49: S3–S13.
- 11) Saito E, Takai J, Kanagawa K, et al.: Changes in functional capacity in older adults living alone: a three-year longitudinal study in a rural area of Japan. *Jpn J Public Health*, 2004, 51: 958–968.
- 12) Kempen GI, Ranchor AV, van Sonderen E, et al.: Risk and protective factors of different functional trajectories in older persons: Are these the same?. *J Gerontol B Psychol Sci Soc Sci*, 2006, 61B: 95–101.
- 13) Maruyama H: Trends in rehabilitation for the Elderly. *J Phys Ther Sci* 2004, 19: 163–167.
- 14) Stessman J, Hammerman R, Maaravi Y, et al.: Strategies to enhance longevity and independent function: the Jerusalem Longitudinal Study. *Mech Ageing Dev*, 2005, 126: 327–331.
- 15) Stevens JA, Powell KE, Smith SM, et al.: Physical activity, functional limitations, and the risk of fall-related fractures in community-dwelling

- elderly. *Ann Epidemiol*, 1997, 7: 54–61.
- 16) Anne T, Shimada C: Social interaction and mortality in a five year longitudinal study of the elderly. *Jpn J Public Health*, 2000, 47: 127–133.
 - 17) Anne, T: A health-social study for developing the evaluation of environmental stimulation and the relation of physical deterioration after three years. *J SYSTED*, 1997a, 6: 349–353.
 - 18) Anne, T: Evaluation of environmental stimulation and its relation to physical deterioration in the elderly after 3 years: A health-social longitudinal study. *Jpn J Public Health*, 1997, 44: 159–166.
 - 19) Anne T, Shinohara R, Sugisawa Y, et al.: Social interaction and mortality: a seven-year longitudinal study of elderly people. *Jpn J Public Health*, 2006, 53: 681–687.
 - 20) Anne T: Study to develop “Index of Social Interaction”. *J National Rehabilitation Center for the Disabled*, 1992, 13: 1–7.
 - 21) Anne T: Index of Social Interaction and physical deterioration. *Jpn Social Welfare*, 1995, 3: 59–73.
 - 22) Monfardini S, Fratino L, Zagonel V, et al.: How much does performance status correlate with multidimensional geriatric assessment in elderly patients with cancer (EPC). *Eur J Cancer*, 1995, 31: 255–256.
 - 23) McAuley, E, Lavsky SE, Motl RW, et al.: Physical activity, self-efficacy, and self-esteem: Longitudinal relationships in older adults. *J Gerontol B Psychol Sci Soc Sci*, 2005, 60B: 268–275.
 - 24) Ishii M, Akiguchi I: Recovery Process of Gait Disturbance after Ventriculo-Peritoneal Shunt in Patients with Idiopathic Normal Pressure Hydrocephalus, *J Phys Ther Sci*, 2007, 29: 183–188.
 - 25) Wong, ST, Yoo GJ, Stewart AL: The changing meaning of family support among older Chinese and Korean immigrants. *J Gerontol B Psychol Sci Soc Sci*, 2006, 61B : S4–S9.